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<p>(21) International Application Number: PCT/US00/09650 (22) International Filing Date: 7 April 2000 (07.04.00) (30) Priority Data: 09/288,775 8 April 1999 (08.04.99) US (71) Applicant: FREE-FLOW PACKAGING INTERNATIONAL, INC. [US/US]; 1090 Mills Way, Redwood City, CA 94063-3120 (US). (72) Inventors: FUSS, Gunter, G.; 932 Peninsula Avenue, No. 408, San Mateo, CA 94401 (US). YAMPOLSKY, Vladimir; 3330 Brittan Avenue, #5, San Carlos, CA 94070 (US). (74) Agents: WRIGHT, Edward, S. et al.; Flehr Hohbach Test Albritton & Herbert LLP, Suite 3400, 4 Embarcadero Center, San Francisco, CA 94111-4187 (US).</p>		<p>(81) Designated States: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.</p>
<p>(54) Title: TEAR-OFF CUSHIONS OF LOOSE FILL PACKING MATERIAL, AND MACHINE AND METHOD FOR MAKING THE SAME</p> <p>(57) Abstract</p> <p>String of packing cushions (73) formed by two superposed layers of flexible plastic film sealed together along transversely extending lines to form a series of closed chambers, loose fill packing material (69) in the chambers (74), and perforations (75) in the film between the chambers defining tear lines by which the cushions can be separated. In certain disclosed embodiments, the string of cushions is made by positioning an elongated length of flexible plastic tubing (24) about a chute (22, 23), drawing a section of the tubing from the chute (33), introducing loose fill packing material through the chute into the section of the tubing which has been drawn from the chute, sealing the walls of the tubing together along transversely extending seal lines above the loose fill packing material to close the section and form a cushion (49, 51), perforating the tubing along a transversely extending tear line above the cushion (61), and repeating the process to form successive cushions separated by tear lines.</p>		

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**TEAR-OFF CUSHIONS OF LOOSE FILL PACKING MATERIAL,
AND MACHINE AND METHOD FOR MAKING THE SAME**

This invention pertains generally to loose fill packing materials and, more particularly, to the packaging of loose fill packing materials in bags for use as cushions in shipping cartons and the like.

5 Loose fill packing materials are widely used in the protective packing of articles for shipment. They are commonly poured into a carton so as to surround and embrace the articles and thereby cushion them during shipment. Loose fill materials are fabricated of a variety of materials such as foamed plastics and, more recently, starch and other biodegradable materials.

10

One problem with loose fill materials is that they tend to spill both during packaging and also when the cartons are opened and the articles packed in them are removed. Being light in weight, the materials also have a tendency to fly about, and some of them exhibit a static cling which makes them particularly
15 difficult to deal with.

U.S. Patents 5,778,642, 5,782,061, 5,782,067 and 5,826,404 disclose manually operated machines for packaging loose fill packing materials in bags for use as cushions in shipping cartons. This solves the problems of spillage and static
20 cling while retaining the advantages of loose fill materials. However, the cushions are formed individually, and the machines were intended for use at or near the locations where the cushions are used. That is a disadvantage for shippers who do not want to make their own cushions or to have the equipment for making the cushions in their facilities.

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It is in general an object of the invention to provide a new and improved packing cushion and machine and method for making the same.

- 5 Another object of the invention is to provide a packing cushion, machine and method of the above character which eliminates the messiness, spillage and static cling which occur when articles are packed in loose fill materials.

10 These and other objects are achieved in accordance with the invention by providing a string of cushions formed by two superposed layers of flexible plastic film sealed together along transversely extending lines to form a series of closed chambers, loose fill packing material in the chambers, and perforations in the film between the chambers defining tear lines by which the cushions can be separated. In certain disclosed embodiments, the string of
15 cushions is made by positioning an elongated length of flexible plastic tubing about a chute, drawing a section of the tubing from the chute, introducing loose fill packing material through the chute into the section of the tubing which has been drawn from the chute, sealing the walls of the tubing together along a transversely extending seal line above the loose fill packing material to close
20 the section and form a cushion, perforating the tubing along a transversely extending tear line above the cushion, and repeating the process to form successive cushions separated by tear lines.

25 Figure 1 is a front elevational view, partly broken away, of one embodiment of a machine for making packing cushions in accordance with the invention.

Figure 2 is a fragmentary vertical sectional view of the embodiment of Figure 1.

30 Figure 3 is a horizontal sectional view taken along line 3—3 in Figure 1.

Figure 4 is a fragmentary side elevational view of the embodiment of Figure 1.

Figure 5 is a fragmentary vertical sectional view of the embodiment of Figure 1.

5

Figure 6 is a fragmentary horizontal sectional view taken along line 6—6 in Figure 1.

Figure 7 is a simplified block diagram of the control system in the embodiment of Figure 1.

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Figures 8A - 8C are schematic views illustrating the operation of the embodiment of Figure 1.

Figure 9 is a fragmentary isometric view of a string of packing cushions made in accordance with the invention.

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Figure 10 is an elevational view, somewhat schematic, of a system for bagging the cushions made by the embodiment of Figure 1.

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Figure 11 is a fragmentary elevational view, somewhat schematic, of another embodiment of a machine for making packing cushions in accordance with the invention.

Figure 12 is an isometric view of a dispenser with two bundles of packing cushions manufactured in accordance with the invention.

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Figures 13 and 14 are isometric views of dispensers with rolls of packing cushions manufactured in accordance with the invention.

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Figure 15 is an isometric view of a dispenser with a bag of packing cushions

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manufactured in accordance with the invention.

5 In Figure 1, the machine is illustrated in conjunction with a hopper 15 which holds a supply of loose fill packing material. The hopper is mounted overhead, and the packing material is delivered to it from floor level by an air conveyor (not shown).

10 The machine includes an inlet valve 16 which is connected to the lower portion of the hopper for controlling the flow of material from the hopper. The valve can, for example, be of the type disclosed in U.S. Patent 4,844,291, the disclosure of which is incorporated herein by reference. It has a generally rectangular body 17 with a pair of hinged flaps (not shown) connected to an operator 18 for controlling the flow of material through the valve. The valve has transition pieces 19, 21 on its inlet and outlet sides, with circular collars 22, 23
15 at the outer ends thereof.

A length of flexible tubing 24 is mounted on a tailpiece 26 on the outlet side of the valve for use in the cushions. The tubing is gathered axially and stored on a cylindrical core 27 which rests on a radial flange 28 at the lower end of the
20 tailpiece. The tubing is withdrawn from the core by pulling it down over the flange, with the outer diameter of the flange being slightly larger than the unstretched tubing so that the tubing will not slide off the core unless it is pulled. The tailpiece is removably attached to outlet collar 23 by bayonet mounts 29.

25 In addition to supporting the supply of tubing, the tailpiece serves as a chute through which the loose fill is introduced into the tubing. A pair of air tubes 31 extend into the tailpiece on opposite sides of it and direct jets of air in a downward direction to facilitate movement of the relatively light packing material through the tailpiece.

30

The tubing can be fabricated of any suitable material such as polyethylene, and

can be of any desired weight. In one presently preferred embodiment, the tubing material consists of a mixture of 60 percent low density polyethylene and 40 percent linear low density polyethylene. The tubing is perforated to prevent air from becoming entrapped in the cushions.

5

Means is provided for drawing successive sections of the tubing from the core into communication with the outlet of the valve. This means includes feed rollers 33 which are mounted on swing arms 34 for movement between an extended position in which the rollers engage the tubing and a retracted position in which the rollers are clear of the tubing. Each of the swing arms is mounted on an axle 36 which is pivotally mounted in bearing blocks 37 affixed to the frame of the machine. The feed rollers are mounted on a shaft 38 at the free end of the arm and driven by a gear motor 39 which is mounted on the arm. The driving connection is made by sprockets 41, 42 affixed to the motor and shaft and a drive belt or chain 43 trained about the sprockets. The shaft is rotatively mounted in bearings 44 on the swing arm.

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Air cylinders 46 are connected between arms 47 affixed to the frame and motor mounts 48 on the swing arms for moving the rollers between the extended and retracted positions. In the retracted position, which is shown in full lines in Figure 2, the arms hang vertically beside the tubing and out of engagement with it. When the air cylinders are actuated, the arms swing inwardly and upwardly until the rollers carried by the two arms abut against each other, with the tubing between them. The spinning rollers then draw the tubing from the core and advance it in a downward direction.

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Means is provided for sealing the tubing together along transversely extending lines to form bags into which the loose fill material is dispensed. This means includes a pair of horizontally extending sealing bars 49 and a plurality of plungers 51 for pressing the tubing against the sealing bars. The sealing bars are mounted in a fixed position on one side of the tubing, and are heated by

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internal elements 52. The plungers are mounted on a carriage 53 on the other side of the tubing and are arranged in two horizontally extending rows which are aligned with the sealing bars. The carriage is moved toward and away from the sealing bars by an air cylinder 54.

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Each of the plungers has a ceramic tip 57 mounted on a shaft 58, with a coil spring 59 yieldably urging the plunger toward the sealing bar. The plungers produce individual, spot seals in the areas where they press the tubing against the sealing bars. With a separate spring for each plunger, the plungers act independently of each other, and if a piece of the packing material should become trapped between one of the plungers and a sealing bar, it will not affect the operation of the other plungers.

15

Means is also provided for perforating the tubing to form tear lines between the cushions. This means includes a knife 61 which is mounted in a fixed position on the carriage between the plungers. The knife has a plurality of triangular teeth 62 which face toward the sealing bars and pierce the tubing to form a row of perforations as the tubing is pressed against the sealing bars.

20

The machine is controlled by a programmable logic controller (PLC) 63. The PLC drives a timer 64 which determines how long air cylinders 46 are actuated to maintain the feed rollers in contact with the tubing, which determines the length of the cushions. The amount of loose fill material in each of the cushions is determined by another timer 66 which controls the length of time valve 16 is open. The PLC also controls the movement of carriage 53 and hence the operation of the sealer and perforator. A limit switch 67 activated by movement of carriage 53 is connected to a counter 68 to count the number of cushions which are made.

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Operation and use of the machine, and therein the method of the invention, are as follows. The core of tubing is placed on the tailpiece, and the tailpiece is

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mounted on the valve. The lower portion of the tubing is pulled manually down over the ring on the tailpiece to a point below the sealing bars. When the machine is turned on, carriage 53 moves toward the sealing bars, and plungers 51 press the tubing against the sealing bars to seal the lower portion of the tubing.

As illustrated in Figure 8A, valve 16 is then opened for a predetermined period of time to deliver loose fill material 69 from the hopper to the section of tubing 71 above the seal. Thereafter, the feed rollers 33 are brought into engagement with the tubing, as shown in Figure 8B, and the spinning rollers draw the next section of tubing 72 from the core. At the same time, the section 71 which has been filled advances down past the sealing bars. As noted above, the length of each cushion is determined by the amount of time the feed rollers remain in engagement with the tubing, and the amount of packing material in each cushion is determined by the length of time valve 16 remains open.

After the feed rollers have been retracted, carriage 53 is moved toward the sealing bars, as illustrated in Figure 8C, and plungers 51 press the tubing against the bars to simultaneously seal the upper portion of section 71 and the lower portion of section 72. At the same time, knife teeth 62 pierce the tubing to form a row of perforations between the two seal lines.

The carriage is then retracted, and the process is repeated to form a string of cushions 73 as illustrated in Figure 9. This string comprises of a plurality of cushions 74 with tear lines 75 between them. Each cushion contains a predetermined amount of packing material, and the cushions can be torn apart and used individually or in groups, as desired.

Figure 10 illustrates a system in which the strings of cushions made by the machine are packed into relatively large bags (e.g., 20 ft³) for storage and shipment. In this system, a storage bag 76 is mounted on a framework 77, and

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the string of cushions 73 is fed from the machine to the bag by a drive wheel 78. The drive wheel has a plurality of pins 79 which project from its face by a distance slightly greater than the width of the cushions. The string of cushions emerging from the machine is trained about a J-shaped guide plate 81 at the
5 base of the machine, then up around the pins of the drive wheel, and down into the storage bag. As the cushions emerge, the drive wheel delivers them to the bag. When the bag is full, it is removed from the framework and closed, and another bag is mounted on the framework in its place.

10 Figure 11 illustrates an embodiment in which the tubing is made in running fashion, rather than being gathered and stored on a core in advance. In this embodiment, a roll of plastic film 82 is positioned near tailpiece 26, and as the film is drawn from the roll, it is wrapped around the tailpiece. The edge portions 83 of the film are sealed together to form tubing 84 which is withdrawn from the
15 lower end of the tailpiece and used in the same manner as tubing 24 in the embodiment of Figure 1.

In the embodiment of Figure 12, the strings of cushions 73 are layered in fanfold fashion to form two generally rectangular bundles 86 which are placed
20 side-by-side in a dispenser 87. The dispenser includes a stationary support 88 over which the cushions are withdrawn.

The strings of cushions 73 can also be formed into rolls 89 for storage and use, as illustrated in Figures 13 and 14. In the embodiment of Figure 13, two rolls of
25 the cushions are placed in a floor stand 91 which has a curved bottom wall 92 on which the rolls rest. The free ends of the rolls are trained up and over a curved surface 93 at the front of the dispenser.

In the embodiment of Figure 14, four rolls of the cushions are mounted on a
30 stand 94. This stand has an upright post 96 and a horizontally extending arm 97 on which the rolls are mounted. The arm is attached to a carriage 98 which

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is slidably mounted on the post for movement to different heights, with a cable or rope 99 for raising and lowering the arm. A support arm 101 extends in front of the roll closest to the post for holding the free end of the string away from the roll. In this particular embodiment, the cushions in the roll closest to the post are used first, and the remaining rolls are moved toward the post as they are needed.

Figure 15 illustrates a dispenser for use with cushions packed in a bag 76 as in the embodiment of Figure 10. The dispenser comprises a stand 103 which has base 104 and an upright 106 with a hook 107 on which the bag is hung. The string of cushions 73 is pulled from the bag and trained over a curved support 108 at the upper end of the upright, with the free end of the string hanging down in front of the stand. A hinged flap 109 positioned above the support serves as a one-way gate which permits the cushions to be pulled from the bag, but prevents them from falling back in.

The invention has a number of important features and advantages. It provides the benefits of loose fill materials without the disadvantages and problems normally associated with them. The finished cushions do not require any more space for shipment and storage than the materials from which they are made, and they eliminate the need to make the cushions at or near the point of use. Being formed in strings with tear lines between them, the cushions can be torn apart easily and used individually or in groups, as desired.

It is apparent from the foregoing that a new and improved packing cushion and machine and method for making the same have been provided. While only certain presently preferred embodiments have been described in detail, as will be apparent to those familiar with the art, certain changes and modifications can be made without departing from the scope of the invention as defined by the following claims.

CLAIMS

1. In a machine for manufacturing packing cushions for use in shipping cartons and the like: a chute, an elongated length of flexible plastic tubing disposed coaxially about the chute, means for drawing successive sections of the tubing from the chute, means for introducing loose fill packing material
5 through the chute into a section of the tubing which has been drawn from the chute, means for sealing the walls of the tubing together along a transversely extending seal line above the loose fill packing material to close the section and form a cushion, and means for perforating the tubing along a transversely extending tear line between the section in which the cushion is formed and the
10 next successive section.
2. The machine of Claim 1 wherein the means for drawing successive sections of the tubing from the chute includes drive rollers engagable with the tubing, and a timer for controlling how long the rollers are engaged with the tubing to control the length of the cushions.
3. The machine of Claim 2 wherein the drive rollers are mounted on swing arms for movement toward each other to engage the tubing and away from each other to clear the tubing.
4. The machine of Claim 1 wherein the means for introducing loose fill packing material comprises a valve and means for opening the valve for a predetermined period of time.
5. The machine of Claim 1 wherein the means for sealing the walls of the tubing includes means for sealing the walls together in a plurality of spaced apart areas along the seal line.
6. The machine of Claim 5 wherein the means for sealing the walls of the

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tubing together includes a heated bar on one side of the tubing and a plurality of individual plungers on the other side of the tubing for pressing the tubing against the heated bar in the spaced apart areas.

7. The machine of Claim 1 further including means for forming the tubing around the chute.

8. In a method of manufacturing packing cushions for use in shipping cartons and the like, the steps of: positioning an elongated length of flexible plastic tubing about a chute, drawing a section of the tubing from the chute, introducing loose fill packing material through the chute into the section of the tubing which has been drawn from the chute, sealing the walls of the tubing
5 together along a transversely extending seal line above the loose fill packing material to close the section and form a cushion, perforating the tubing along a transversely extending tear line above the cushion, and repeating the process to form a string of cushions separated by tear lines.

9. The method of Claim 8 wherein the successive sections of tubing are drawn from the chute by periodically engaging the tubing with drive rollers.

10. The method of Claim 9 wherein the drive rollers are alternately swung toward each other to engage the tubing and swung away from each other to clear the tubing.

11. The method of Claim 8 wherein the loose fill packing material is introduced through a valve which is opened for a predetermined period of time.

12. The method of Claim 8 wherein the walls of the tubing are sealed together in a plurality of spaced apart areas along the seal line.

13. The method of Claim 12 wherein the walls of the tubing are sealed

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together by pressing the tubing between a heated bar and a plurality of individual plungers on opposite sides of the tubing.

14. The method of Claim 8 wherein the tubing is folded and gathered axially about the chute.

15. The method of Claim 8 including the steps of feeding a continuous length of plastic film longitudinally of the chute, wrapping the film about the chute, and sealing edge portions of the film together to form the tubing.

16. In a machine for manufacturing packing cushions for use in shipping cartons and the like:

a dispenser having a discharge chute through which loose fill packing material can be discharged;

5 an elongated length of flexible plastic tubing disposed coaxially about the chute;

means for withdrawing successive sections of the tubing from the chute to form bags for receiving loose fill material discharged through the chute;

10 means for actuating the dispenser to introduce loose fill packing material into a bag formed by a first section of the tubing which has been withdrawn from the chute;

means for simultaneously sealing the tubing together along two spaced apart transversely extending seal lines above the packing material in the first bag in order to simultaneously close the upper end of the first bag and the lower end of a second bag formed by the next successive section of tubing; and

15 means for perforating the tubing along a transversely extending tear line between the two seal lines to facilitate separation of the two bags.

17. The machine of Claim 16 wherein the means for withdrawing successive sections of the tubing from the chute includes feed rollers movable between an extended position in which the rollers are in driving engagement with the tubing

and a retracted position in which the rollers are clear of the tubing.

18. The machine of Claim 16 wherein the means for sealing the tubing together includes a pair of vertically spaced transversely extending sealing bars on one side of the tubing and two rows of individual plungers on the other side of the tubing for pressing the tubing against the sealing bars.

19. The machine of Claim 18 wherein the means for perforating the tubing comprises a blade positioned between the two rows of plungers for engagement with the tubing as the plungers press the tubing against the sealing bars.

20. The machine of Claim 1 further including means for forming the tubing around the chute.

21. In a method of manufacturing packing cushions for use in shipping cartons and the like, the steps of:

- positioning an elongated length of flexible plastic tubing about a chute;
- withdrawing successive sections of the tubing from the chute to form
- 5 bags for receiving loose fill material discharged through the chute;
- discharging loose fill packing material through the chute into a bag
- formed by a first section of the tubing which has been withdrawn from the chute;
- sealing the tubing together along two spaced apart transversely
- extending seal lines above the packing material in the first bag in order to close
- 10 the upper end of the first bag and the lower end of a second bag formed by the
- next successive section of tubing; and
- perforating the tubing along a transversely extending tear line between
- the two seal lines to facilitate separation of the two bags.

22. The method of Claim 21 wherein the tubing is withdrawn from the chute by periodically engaging the tubing with feed rollers which are movable

5 between an extended position in which the rollers are in driving engagement with the tubing and a retracted position in which the rollers are clear of the tubing.

23. The method of Claim 21 wherein the tubing is sealed together by engaging one side of the tubing with a plurality of plungers arranged in two horizontally extending rows and pressing the tubing against a pair of vertically spaced transversely extending sealing bars on the other side of the tubing.

24. The method of Claim 23 wherein the tubing is perforated by pressing the teeth of a blade through the tubing as the tubing is pressed against the sealing bars.

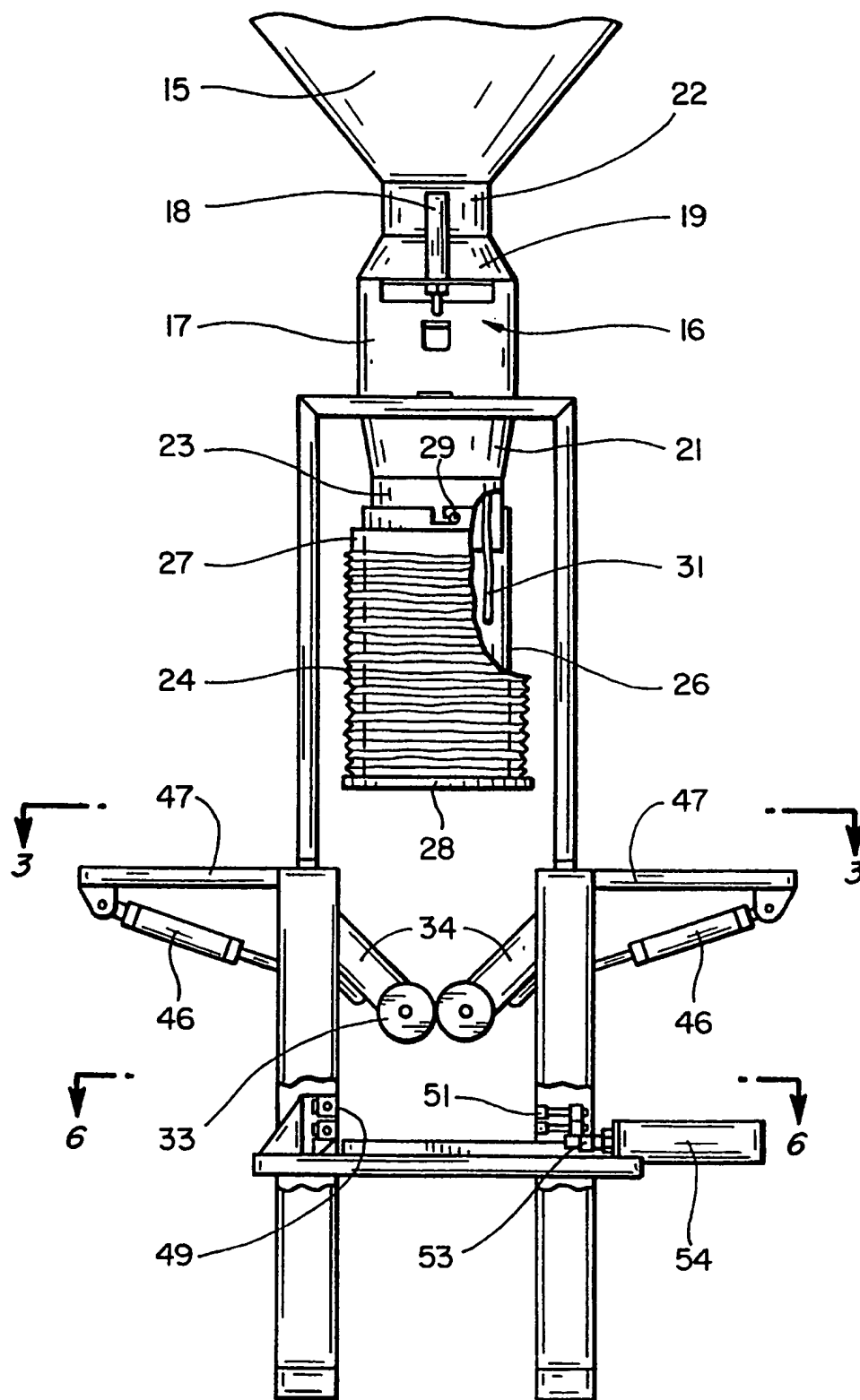
25. The method of Claim 21 including the steps of feeding a continuous length of plastic film longitudinally of the chute, wrapping the film about the chute, and sealing edge portions of the film together to form the tubing.

5 26. A packing material for use in shipping cartons and the like, comprising a string of cushions formed by two superposed layers of flexible plastic film sealed together along transversely extending lines to form a series of closed chambers, loose fill packing material in the chambers, and perforations in the film between the chambers defining tear lines by which the cushions can be separated.

27. The packing material of Claim 26 wherein the film is sealed together along two lines between adjacent ones of the cushions, and the tear lines are positioned between the two seal lines.

28. The packing material of Claim 26 wherein the film is sealed together in discrete spaced apart areas along the transversely extending lines.

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**FIG. 1**

SUBSTITUTE SHEET (RULE 26)

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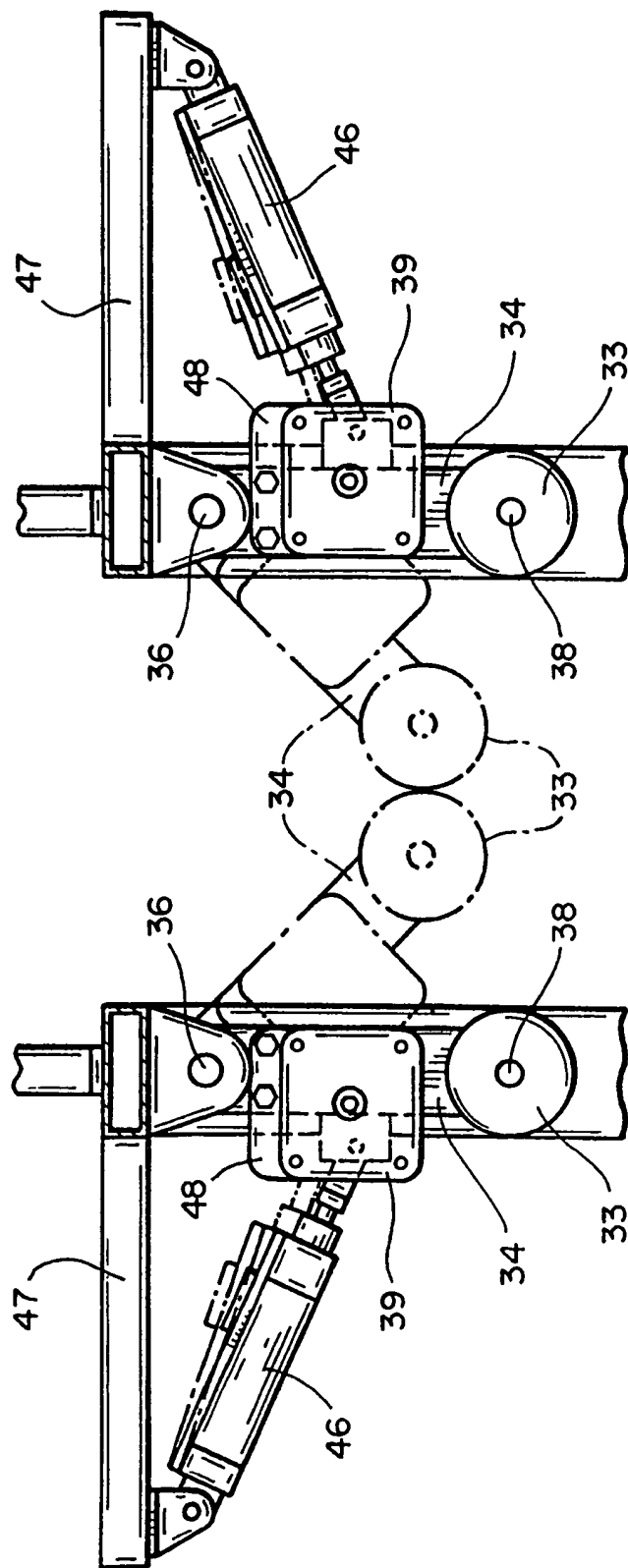
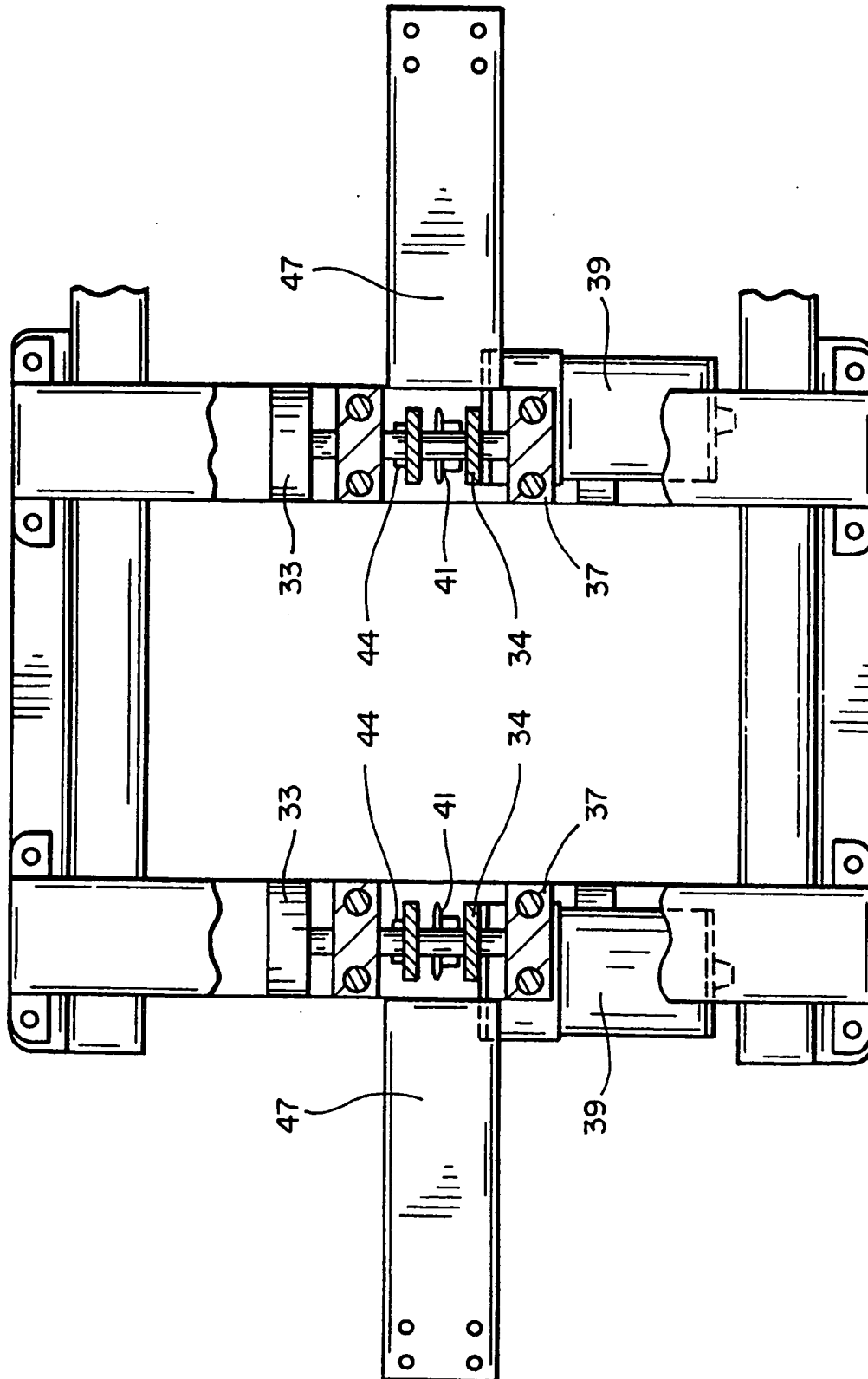


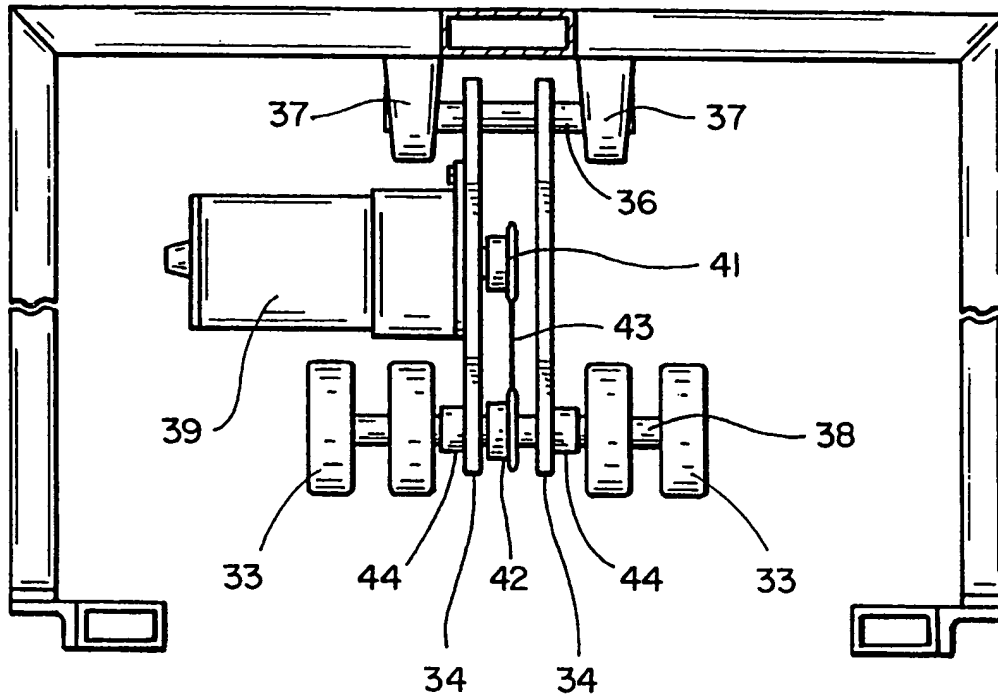
FIG-2

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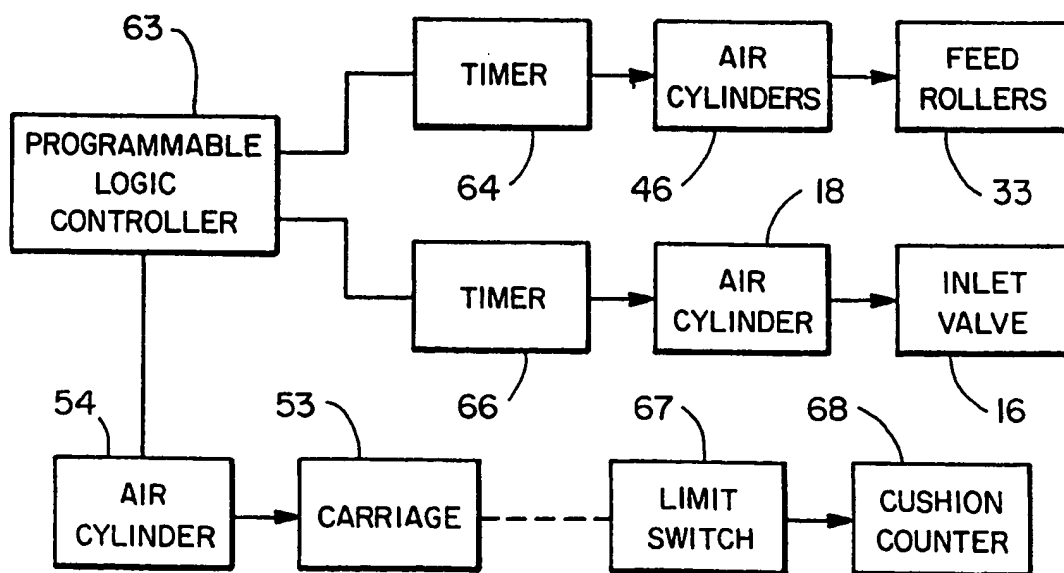


FIG_3

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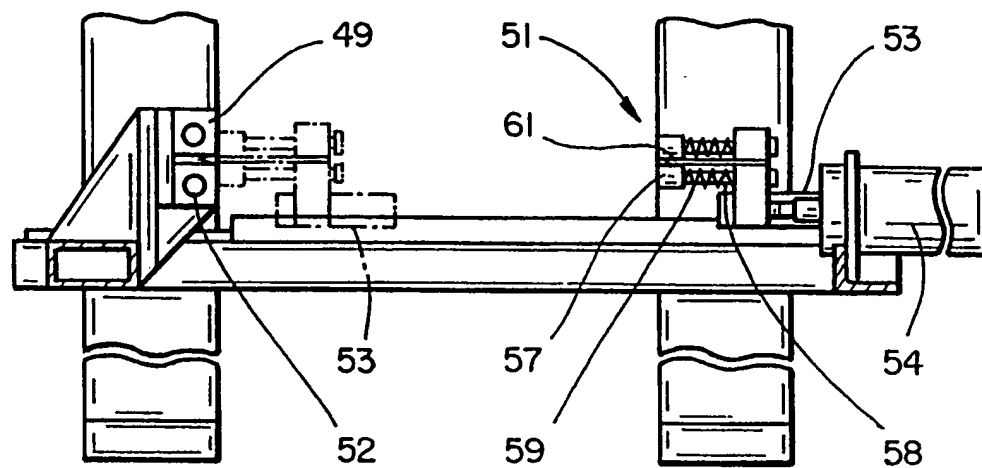


FIG_4

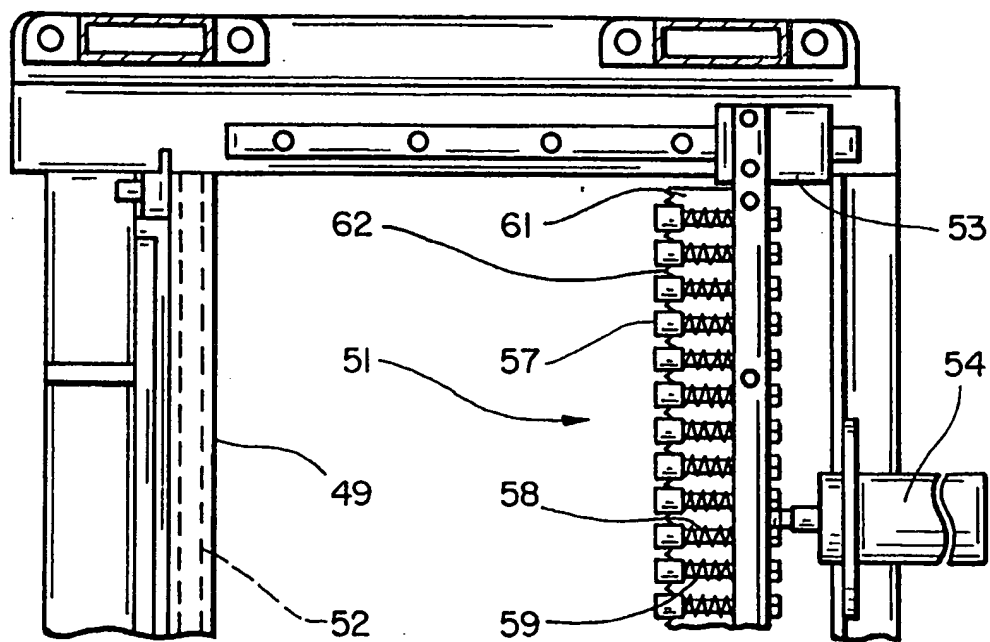


FIG_7

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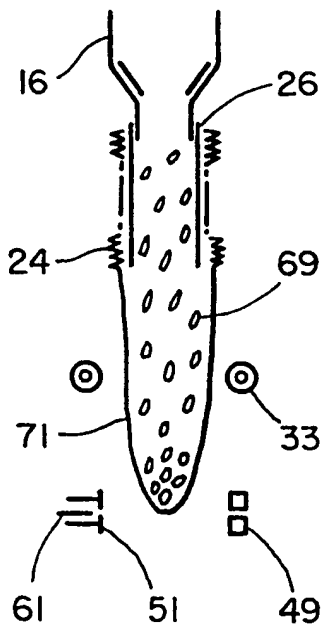


FIG_5

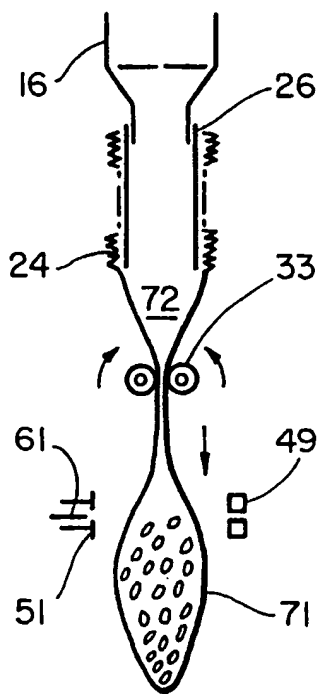


FIG_6

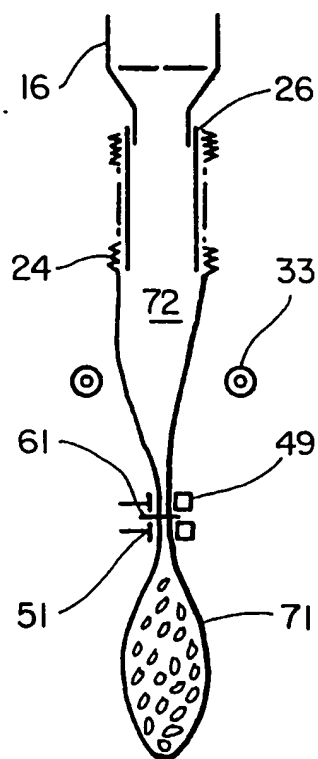
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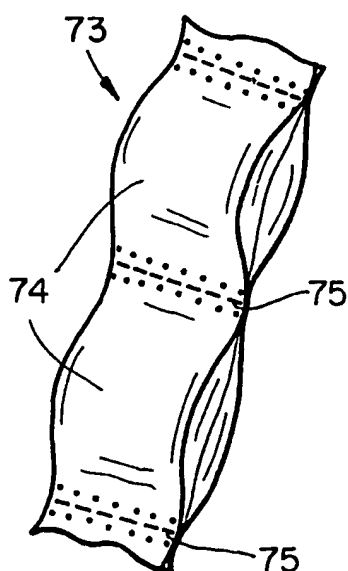
FIG_8A



FIG_8B

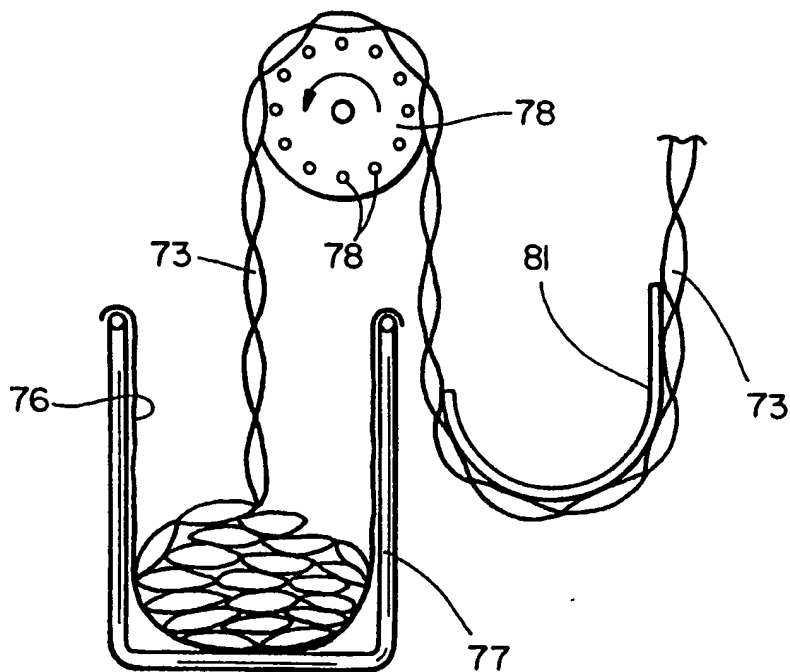


FIG_8C

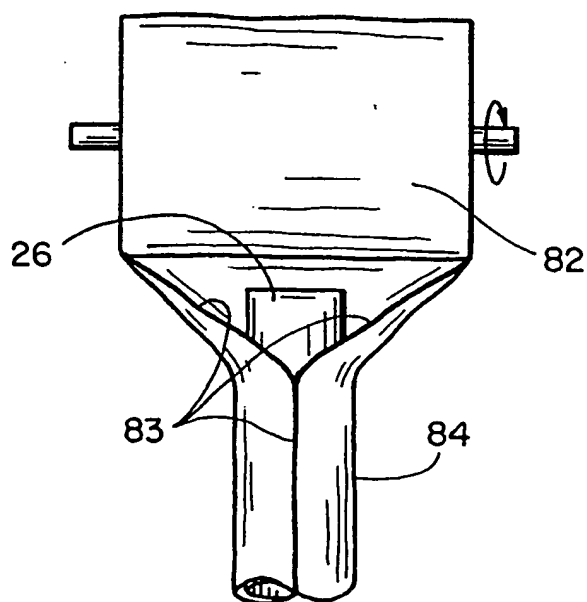


FIG_9

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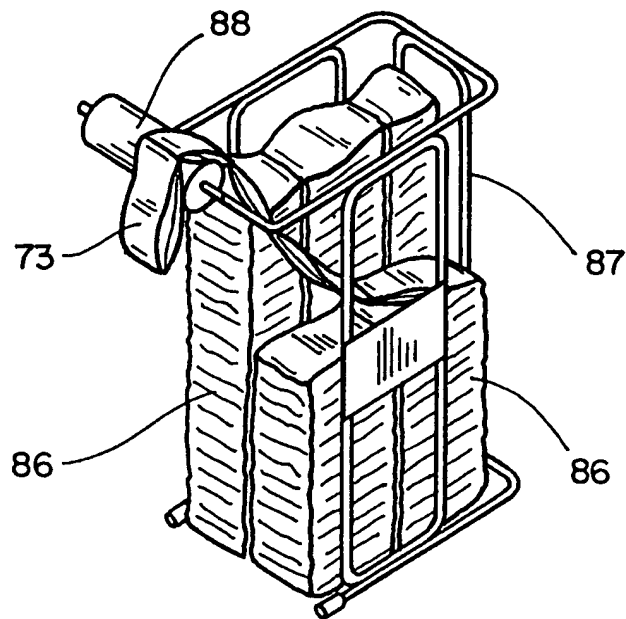


FIG_10

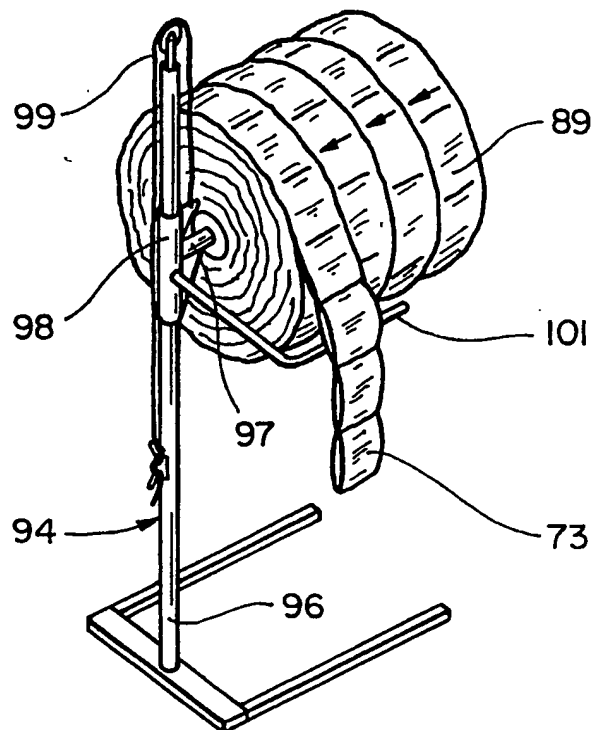


FIG_11

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FIG_12



FIG_14

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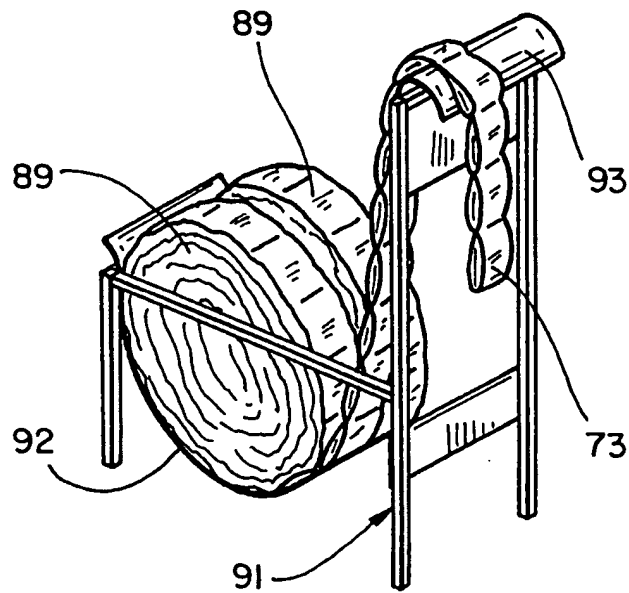


FIG. 13

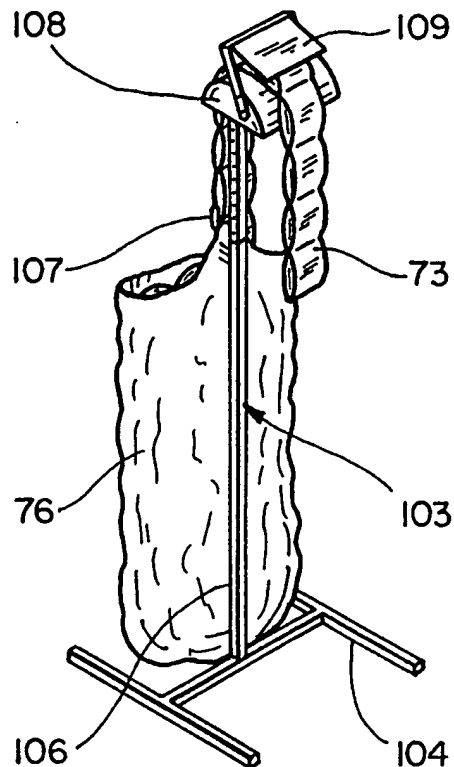


FIG. 15

SUBSTITUTE SHEET (RULE 26)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/09650

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B65B 9/15, 9/20, 23/00; B65D 81/03

US CL : 53/469,472, 576, 389.4; 206/584

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 53/469,472,576,591,389.4; 206/584

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,938,007 A (Sperry) 03 July 1990, entire document	1-25
Y	US 5,693,163 A (Hoover et al) 02 December 1997, entire document	1-25
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X		26-28
A	US 3,938,300 A (Lovquist) 17 February 1976, entire document	1-25
A	US 4,790,124 A (Kaji) 13 December 1988, entire document	1-25
A	US 2,656,658 A (Grady) 27 October 1953, entire document	1-25
Y	US 3,210,908 A (Samberg) 12 October 1965, entire document	1-28
Y	DE 2,701,251 A (Windmoller & Holscher) 20 July 1978, entire abstract	1-28
Y	US 5,673,534 A (Fowler) 07 October 1997, entire document	5,6,12,13
Y	US 1,521,725 A (Stanley) 06 January 1925, entire document	5,6,12,13
Y	US 4,996,819 A (Davis) 05 March 1991, entire document	17
Y	US 3,667,593 A (Pendleton) 06 June 1972, entire document	1-28



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

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Name and mailing address of the ISA/US

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